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Rajeev Joshi

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KENNETH E. HORTON
KIRTON & MCCONKLE
60 EAST SOUTH TEMPLE
SUITE 1800
SALT LAKE CITY, UT 84111

EXAMINER

ZARNEKE, DAVID A

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/731,453	Applicant(s) JOSHI ET AL.	
	Examiner David A. Zarneke	Art Unit 2891	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 September 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 47-72 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 47-72 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

Applicant's arguments filed 9/26/08 have been fully considered but they are not persuasive. Eight arguments are presented with respect to the rejection of the claims.

The first argument is that AAPA [35] is a solder bump and not a stud bump, particularly in light of Figures 2 and 3.

It is not clear how figures 2 and 3 differentiate a solder bump from a stud bump. Further, it is not clear how a solder bump is different from a stud bump in general. Applicant's arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references.

The second argument is that why would one use the adhesive to attach the leadframe of Shibata in the invention of AAPA.

Please note that Shibata is relied upon to teach the substrate of AAPA could be a leadframe. Shibata is not relied upon for any other teachings in the rejection of this claim. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

The third argument is that one wouldn't be motivated to use the insulated metal conductive particles because it costs too much and adds to the complexity of the device.

Clearly, the mere fact that it adds to the costs or is more complex isn't a reason for not adding a limitation to a reference. If there is a benefit to be gained, then that is a reason for using the limitation. In this case, the use of insulated metal conductive particles improves the insulating properties in the lateral direction. Therefore, this benefit provides a reason, or motivation, for using insulated metal conductive particles.

The fourth argument is that AAPA teaches a polymeric insulating layer while the claim calls for a non-polymeric insulating layer.

Please note that the rejection states that AAPA fails to teach a non-polymeric insulating layer and goes on to say that non-polymeric insulating layers are commonly known in the art.

The fifth argument is that it has only been alleged and not proven that Cu can form an eutectic alloy.

Please note that the abstract of Anderson et al., US Patent 5,527,628 states that a Sn-Ag-Cu eutectic is known in the art. This reference proves that Cu can form an eutectic alloy.

The sixth argument is that even though the formation of the stud bump using a Pd coated wire is a product-by-process limitation, it still requires Pd to be in the stud bump.

This argument is persuasive and this office action is therefore made non-final. Please note that Pd-coated wires are commonly known and used in the industry. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

The seventh argument is that a BT epoxy substrate can not be used in Shibata since Shibata specifically teaches away from using epoxy resin substrates (2, 18-21).

Please note that Shibata teaches away from glass epoxy substrates, not BT epoxy substrates or epoxy substrates in general.

The final argument is that the UBM can't be omitted because the function of the UBM is a desired property that makes the pad work better. The focus isn't on whether the function is required, but if it is desired.

Please note that that the first paragraph of MPEP 2144.04(II) states:

"The Board affirmed the rejection, holding that it would have been obvious to omit the polybasic acid salts of the primary reference where the function attributed to such salt is **not desired or required** (bold added for emphasis), such as in compositions for providing corrosion resistance in environments which do not encounter fresh water.)"

This clearly states that the function can not be desired or required. Therefore the argument that this section of the MPEP is only directed to whether the function is **desired** is incorrect. Clearly whether the function is **required** is also a consideration.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 47-54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Admitted Prior Art (hereafter AAPA) Figures 1-3, in view of Shibata, US Patent 6,461,890 and Kaneda et al., US Patent 6,223,429.

AAPA teaches a wafer-level chip scale package, comprising:

- a substrate [5] containing a chip pad [40];
- a re-distributed line (RDL) pattern [20] on the chip pad;
- an insulating layer [25] covering a portion of the RDL pattern;
- a stud bump [35] located on the portion of the RDL pattern not covered by the insulating layer.

AAPA fails to teach a leadframe substrate containing a bond pad; and

an adhesive material containing conductive particles located between the chip and the substrate.

Shibata (Figures 5 & 6) teaches:

a chip [10] containing a stud bump [11];

a leadframe substrate [60] containing a bond pad [61]; and

an adhesive material [30] containing conductive particles [32] located between the chip and the substrate.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the leadframe with the claimed conductive adhesive because it is conventionally known in the art to connect a chip to a leadframe using a conductive adhesive. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

Further, AAPA and Shibata fail to teach the conductive particles comprise metal with an insulating layer.

Kaneda (6, 35+) teaches the conductive particles comprise metal with an insulating layer.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the conductive particles of Kaneda in the invention of Shibata because Kaneda teaches conductive particles comprising metal with an insulating layer improves insulating properties in the lateral direction of metal particles (6, 35+).

Lastly, AAPA, Shibata and Kaneda fail to teach the insulating layer comprises a non-polymeric dielectric material.

AAPA is silent as to the specific material used as the insulating layer that covers the RDL, the use of a non-polymeric insulator would have been obvious to one of ordinary skill in the art because insulating layers are known to be made of both polymeric and non-polymeric materials, such as silicon dioxide, are commonly known generic materials used as insulating layers. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

Regarding claim 48, Shibata teaches at least one conductive particle is located between the stud bump and the bond pad (figure 6).

With respect to claim 49, Shibata teaches the adhesive material comprises an anisotropic conductive film, an anisotropic conductive paste, or an isotropic conductive paste (7, 64+).

As to claim 50, Shibata, which teaches the bump is made of gold (7, 45+), teaches the package does not contain any solder paste.

In re claim 51, while Shibata, which teaches the use of gold (Au) bumps (7, 45+), fails to teach the stud bump comprises Cu, it would have been obvious to one of ordinary skill in the art at the time of the invention to use Cu in the invention of Shibata because Au and Cu are materials known to a skilled artisan to be equivalent. Both are well known in the art materials used as bumps, as taught by Tummala et al., Microelectronics Packaging Handbook: Semiconductor Packaging - Part II, 1997, pp II-207. The substitution of one known equivalent technique for another may be obvious even if the prior art does not expressly suggest the substitution (Ex parte Novak 16 USPQ 2d 2041 (BPAI 1989); In re Mostovych 144 USPQ 38 (CCPA 1964); In re Leshin

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125 USPQ 416 (CCPA 1960); Graver Tank & Manufacturing Co. V. Linde Air Products Co. 85 USPQ 328 (USSC 1950).

Regarding claim 52, AAPA, Shibata and Kaneda fail to teach the stud bump is formed by wire bonding a Pd coated copper wire to the RDL pattern using a capillary to provide the stud bump with a coined shape.

Please note that using by wire bonding a Pd coated copper wire to the RDL pattern using a capillary to provide the stud bump is a process limitation is a product claim and therefore isn't given any patentable weight. Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985)

Further, relating to the coined shape, while Shibata fails to teach the stud bump is a coined stud bump, it would have been obvious to one of ordinary skill in the art at the time of the invention to use a coined stud bump in the invention of Shibata because the use of a stud bump or a coined stud bump are equivalent. A skilled artisan knows that each are commonly known and used bumps to interconnect a die to a substrate, as taught by Lau, Flip Chip Technologies, 1996, pp. 129-131. The substitution of one known equivalent technique for another may be obvious even if the prior art does not expressly suggest the substitution (Ex parte Novak 16 USPQ 2d 2041 (BPAI 1989); In

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re Mostovych 144 USPQ 38 (CCPA 1964); In re Leshin 125 USPQ 416 (CCPA 1960); Graver Tank & Manufacturing Co. V. Linde Air Products Co. 85 USPQ 328 (USSC 1950).

Lastly, while AAPA and Shibata fail to teach the use a Pd coated bump or a bump that includes Pd (the bump resulting from a Pd-coated Cu wire would either be coated by or include/alloy with Pd upon reflow), it would have been obvious to one of ordinary skill in the art at the time of the invention to use Pd and Cu bumps in the invention of AAPA and Shibata because they are conventionally known and used in the art. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

With respect to claim 53, while AAPA fails to teach the insulating layer comprises silicon nitride, silicon oxide, or silicon oxynitride, it would have been obvious to one of ordinary skill in the art at the time of the invention to use silicon nitride, silicon oxide, or silicon oxynitride as the insulating layer in the invention of AAPA because they are conventionally known and used insulating layers known to each and every skilled artisan. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

As to claim 54, while AAPA fails to teach there is no under bump metal under the stud bump, it would have been obvious to one of ordinary skill in the art at the time of the invention to remove the UBM of AAPA because the omission of an element and its function is obvious if the function of the element is not desired (MPEP 2144.04 IIA).

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The device would work without the UBM, therefore it would be obvious to remove it and its desired function in order to reduce cost.

Claims 55-61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Admitted Prior Art (hereafter AAPA) Figures 1-3, in view of Shibata, US Patent 6,461,890 and Kaneda et al., US Patent 6,223,429.

AAPA teaches a wafer-level chip scale package, comprising:

- a substrate [5] containing a chip pad [40];
- a re-distributed line (RDL) pattern [20] on the chip pad;
- an insulating layer [25] covering a portion of the RDL pattern;
- a stud bump [35] located on the portion of the RDL pattern not covered by the insulating layer.

AAPA fails to teach a leadframe substrate containing a bond pad; and
an adhesive material containing conductive particles located between the chip and the substrate.

Shibata (Figures 5 & 6) teaches:

- a chip [10] containing a stud bump [11];
- a leadframe substrate [60] containing a bond pad [61]; and
- an adhesive material [30] containing conductive particles [32] located between the chip and the substrate.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the leadframe with the claimed conductive adhesive because it is conventionally known in the art to connect a chip to a leadframe using a conductive

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adhesive. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

Further, AAPA and Shibata fail to teach the conductive particles comprise metal with an insulating layer with an insulating layer with at least one conductive particle contacting both the stud bump and the bond pad.

Kaneda (6, 35+) teaches the conductive particles comprise metal with an insulating layer with at least one conductive particle contacting both the stud bump and the bond pad.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the conductive particles of Kaneda in the invention of Shibata because Kaneda teaches conductive particles comprising metal with an insulating layer improves insulating properties in the lateral direction of metal particles (6, 35+).

Also, AAPA, Shibata and Kaneda fail to teach the insulating layer comprises a non-polymeric dielectric material.

AAPA is silent as to the specific material used as the insulating layer that covers the RDL, the use of a non-polymeric insulator would have been obvious to one of ordinary skill in the art because insulating layers are known to be made of both polymeric and non-polymeric materials, such as silicon dioxide, are commonly known generic materials used as insulating layers. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

Lastly, AAPA fails to teach the stud bump contains Cu.

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While Shibata, which teaches the use of gold (Au) bumps (7, 45+), fails to teach the stud bump comprises Cu, it would have been obvious to one of ordinary skill in the art at the time of the invention to use Cu in the invention of Shibata because Au and Cu are materials known to a skilled artisan to be equivalent. Both are well known in the art materials used as bumps, as taught by Tummala et al., Microelectronics Packaging Handbook: Semiconductor Packaging - Part II, 1997, pp II- 207. The substitution of one known equivalent technique for another may be obvious even if the prior art does not expressly suggest the substitution (Ex parte Novak 16 USPQ 2d 2041 (BPAI 1989); In re Mostovych 144 USPQ 38 (CCPA 1964); In re Leshin 125 USPQ 416 (CCPA 1960); Graver Tank & Manufacturing Co. V. Linde Air Products Co. 85 USPQ 328 (USSC 1950).

With respect to claim 56, Shibata teaches the adhesive material comprises an anisotropic conductive film, an anisotropic conductive paste, or an isotropic conductive paste (7, 64+).

As to claim 57, Shibata, which teaches the bump is made of gold (7, 45+), teaches the package does not contain any solder paste.

With respect to claim 58, while AAPA fails to teach the insulating layer comprises silicon nitride, silicon oxide, or silicon oxynitride, it would have been obvious to one of ordinary skill in the art at the time of the invention to use silicon nitride, silicon oxide, or silicon oxynitride as the insulating layer in the invention of AAPA because they are conventionally known and used insulating layers known to each and every skilled

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artisan. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

As to claim 59, while AAPA fails to teach there is no under bump metal under the stud bump, it would have been obvious to one of ordinary skill in the art at the time of the invention to remove the UBM of AAPA because the omission of an element and its function is obvious if the function of the element is not desired (MPEP 2144.04 IIA). The device would work without the UBM, therefore it would be obvious to remove it and its desired function in order to reduce cost.

Regarding claim 60, AAPA, Shibata and Kaneda fail to teach the stud bump is formed by wire bonding a Pd coated copper wire to the RDL pattern using a capillary to provide the stud bump with a coined shape.

Please note that using by wire bonding a Pd coated copper wire to the RDL pattern using a capillary to provide the stud bump is a process limitation is a product claim and therefore isn't given any patentable weight. Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985)

Further, relating to the coined shape, while Shibata fails to teach the stud bump is a coined stud bump, it would have been obvious to one of ordinary skill in the art at

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the time of the invention to use a coined stud bump in the invention of Shibata because the use of a stud bump or a coined stud bump are equivalent. A skilled artisan knows that each are commonly known and used bumps to interconnect a die to a substrate, as taught by Lau, Flip Chip Technologies, 1996, pp. 129-131. The substitution of one known equivalent technique for another may be obvious even if the prior art does not expressly suggest the substitution (Ex parte Novak 16 USPQ 2d 2041 (BPAI 1989); In re Mostovych 144 USPQ 38 (CCPA 1964); In re Leshin 125 USPQ 416 (CCPA 1960); Graver Tank & Manufacturing Co. V. Linde Air Products Co. 85 USPQ 328 (USSC 1950).

Lastly, while AAPA and Shibata fail to teach the use a Pd coated bump or a bump that includes Pd (the bump resulting from a Pd-coated Cu wire would either be coated by or include/alloy with Pd upon reflow), it would have been obvious to one of ordinary skill in the art at the time of the invention to use Pd and Cu bumps in the invention of AAPA and Shibata because they are conventionally known and used in the art. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

Claims 61, and 63-66 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Admitted Prior Art (hereafter AAPA) Figures 1-3, in view of Shibata, US Patent 6,461,890.

AAPA teaches a wafer-level chip scale package, comprising:

a substrate [5] containing an integrated circuit [40];

a re-distributed line (RDL) pattern [20] on the substrate and the integrated circuit;

an insulating layer [25] covering a portion of the RDL pattern;
a non-reflowed stud bump [35] located on the portion of the RDL pattern not covered by the insulating layer.

AAPA fails to teach a leadframe substrate containing a bond pad; and
an adhesive material containing conductive particles located between the chip and the substrate.

Shibata (Figures 5 & 6) teaches:
a chip [10] containing a stud bump [11];
a leadframe substrate [60] containing a bond pad [61]; and
an adhesive material [30] containing conductive particles [32] located between the chip and the substrate.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the leadframe with the claimed conductive adhesive because it is conventionally known in the art to connect a chip to a leadframe using a conductive adhesive. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

Lastly, AAPA, and Shibata fail to teach the insulating layer comprises a non-polymeric dielectric material.

AAPA is silent as to the specific material used as the insulating layer that covers the RDL, the use of a non-polymeric insulator would have been obvious to one of ordinary skill in the art because insulating layers are known to be made of both polymeric and non-polymeric materials, such as silicon dioxide, are commonly known

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generic materials used as insulating layers. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

Please note that while AAPA fails to specifically teach the stud bump is non-reflowed, it would have been obvious to one of ordinary skill in the art that the bump would have non-reflowed at the time of deposition and then later reflowed. Therefore, there was a point in the process wherein the stud bump was non-reflowed. This rejection relies upon that moment in time.

Regarding claim 63, Shibata teaches the adhesive material comprises an anisotropic conductive film, an anisotropic conductive paste, or an isotropic conductive paste (7, 64+).

As to claim 64, Shibata, which teaches the bump is made of gold (7, 45+), teaches the package does not contain any solder paste.

In re claim 65, while Shibata, which teaches the use of gold (Au) bumps (7, 45+), fails to teach the stud bump comprises Cu, it would have been obvious to one of ordinary skill in the art at the time of the invention to use Cu in the invention of Shibata because Au and Cu are materials known to a skilled artisan to be equivalent. Both are well known in the art materials used as bumps, as taught by Tummala et al., Microelectronics Packaging Handbook: Semiconductor Packaging - Part II, 1997, pp II-207. The substitution of one known equivalent technique for another may be obvious even if the prior art does not expressly suggest the substitution (Ex parte Novak 16 USPQ 2d 2041 (BPAI 1989); In re Mostovych 144 USPQ 38 (CCPA 1964); In re Leshin

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125 USPQ 416 (CCPA 1960); Graver Tank & Manufacturing Co. V. Linde Air Products Co. 85 USPQ 328 (USSC 1950).

As to claim 66, while AAPA fails to teach there is no under bump metal under the stud bump, it would have been obvious to one of ordinary skill in the art at the time of the invention to remove the UBM of AAPA because the omission of an element and its function is obvious if the function of the element is not desired (MPEP 2144.04 IIA). The device would work without the UBM, therefore it would be obvious to remove it and its desired function in order to reduce cost.

Claim 62 is rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Admitted Prior Art (hereafter AAPA) Figures 1-3, in view of Shibata, US Patent 6,461,890, as applied to claim 61 above, and further in view of Kaneda et al., US Patent 6,223,429.

AAPA and Shibata fail to teach the conductive particles comprise metal with an insulating layer.

Kaneda (6, 35+) teaches the conductive particles comprise metal with an insulating layer.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the conductive particles of Kaneda in the invention of Shibata because Kaneda teaches conductive particles comprising metal with an insulating layer improves insulating properties in the lateral direction of metal particles (6, 35+).

Claims 67-72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Admitted Prior Art (hereafter AAPA) Figures 1-3, in view of Shibata, US Patent 6,461,890 and Kaneda et al., US Patent 6,223,429.

AAPA teaches an electronic apparatus containing a packaged semiconductor device without solder paste, comprising:

- a substrate [5] containing a chip pad [40];
- a re-distributed line (RDL) pattern [20] on the chip pad;
- an insulating layer [25] covering a portion of the RDL pattern;
- a stud bump [35] located on the portion of the RDL pattern not covered by the insulating layer.

AAPA fails to teach a leadframe substrate containing a bond pad; and
an adhesive material containing conductive particles located between the chip and the substrate with at least one conductive particle contacting both the stud bump and the bond pad.

Shibata (Figures 5 & 6) teaches:

- a chip [10] containing a stud bump [11];
- a leadframe substrate [60] containing a bond pad [61]; and
- an adhesive material [30] containing conductive particles [32] located between the chip and the substrate with at least one conductive particle contacting both the stud bump and the bond pad.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the leadframe with the claimed conductive adhesive because it is

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conventionally known in the art to connect a chip to a leadframe using a conductive adhesive. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

Further, AAPA and Shibata fail to teach the conductive particles comprise metal with an insulating layer.

Kaneda (6, 35+) teaches the conductive particles comprise metal with an insulating layer.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the conductive particles of Kaneda in the invention of Shibata because Kaneda teaches conductive particles comprising metal with an insulating layer improves insulating properties in the lateral direction of metal particles (6, 35+).

Also, AAPA, Shibata and Kaneda fail to teach the insulating layer comprises a non-polymeric dielectric material.

AAPA is silent as to the specific material used as the insulating layer that covers the RDL, the use of a non-polymeric insulator would have been obvious to one of ordinary skill in the art because insulating layers are known to be made of both polymeric and non-polymeric materials, such as silicon dioxide, are commonly known generic materials used as insulating layers. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

Lastly, AAPA fails to teach the stud bump contains Cu.

While Shibata, which teaches the use of gold (Au) bumps (7, 45+), fails to teach the stud bump comprises Cu, it would have been obvious to one of ordinary skill in the

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art at the time of the invention to use Cu in the invention of Shibata because Au and Cu are materials known to a skilled artisan to be equivalent. Both are well known in the art materials used as bumps, as taught by Tummala et al., Microelectronics Packaging Handbook: Semiconductor Packaging - Part II, 1997, pp II- 207. The substitution of one known equivalent technique for another may be obvious even if the prior art does not expressly suggest the substitution (Ex parte Novak 16 USPQ 2d 2041 (BPAI 1989); In re Mostovych 144 USPQ 38 (CCPA 1964); In re Leshin 125 USPQ 416 (CCPA 1960); Graver Tank & Manufacturing Co. V. Linde Air Products Co. 85 USPQ 328 (USSC 1950).

Regarding claim 68, Shibata teaches the adhesive material comprises an anisotropic conductive film, an anisotropic conductive paste, or an isotropic conductive paste (7, 64+).

As to claims 69 and 72, Shibata, which teaches the bump is made of gold (7, 45+), teaches the package does not contain any solder paste.

With respect to claim 70, while AAPA fails to teach the insulating layer comprises silicon nitride, silicon oxide, or silicon oxynitride, it would have been obvious to one of ordinary skill in the art at the time of the invention to use silicon nitride, silicon oxide, or silicon oxynitride as the insulating layer in the invention of AAPA because they are conventionally known and used insulating layers known to each and every skilled artisan. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

As to claim 71, while AAPA fails to teach there is no under bump metal under the stud bump, it would have been obvious to one of ordinary skill in the art at the time of the invention to remove the UBM of AAPA because the omission of an element and its function is obvious if the function of the element is not desired (MPEP 2144.04 IIA). The device would work without the UBM, therefore it would be obvious to remove it and its desired function in order to reduce cost.

In re claim 72, while AAPA fails to teach the use of a BT epoxy substrate as the leadframe substrate, it would have been obvious to one of ordinary skill in the art at the time of the invention to use a BT epoxy substrate in the invention of Shibata because BT epoxy substrates are conventionally known and used in the art. The use of conventional materials to perform their known functions is obvious (MPEP 2144.07).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David A. Zarneke whose telephone number is (571)-272-1937. The examiner can normally be reached on M-Th 7:30 AM-6 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sue Purvis can be reached on (571)-272-1236. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/David A. Zarneke/
Primary Examiner, Art Unit 2891
1/1/09